

C<sup>1</sup>  
a ballasted lower section;

a truss member separating the floating hull from the lower ballasted section;

an anchoring system connecting the floating hull to the ocean floor; and

9 a vertically oriented fairing shaped profile section presented on the hull <sup>for reducing vortex induced vibrations</sup>

## REMARKS

### Objections to Claim 1

In Paragraph 3 of the Office Action, the Examiner rejects claim 1 as a result of informalities appearing in the claim language. Attorney respectfully submits that the objections set forth by the Examiner are moot in light of the above amendment to claim 1.

### Rejection of Claims 1, 2, and 4-8 under 35 U.S.C. §112, ¶2

Paragraphs 4 and 5 of the Office Action reject claims 1, 2 and 4-8 as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Specifically, it was stated that the language used in claim 1 failed to note how elements of the invention, the upper buoyant hull, the ballasted lower section and the truss member were structurally related. Attorney has amended claim 1 substantially as suggested by the Examiner to address the grounds for rejection under §112, ¶2.

### Rejection of Claims 1, 2 and 4-8 under 35 U.S.C. § 103(a)

In Paragraphs 6-8 of the Office Action, the Examiner rejects claims 1, 2 and 4-8 under 35 U.S.C. §103(a). Claims 1 and 2 are rejected as being unpatentable over Horton (USP 5,558,467) in view of Moisdon (USP 4,656,959). Specifically, its states that Horton '467 discloses a deep water offshore apparatus having a vertically oriented floating hull with a buoyant upper section, a ballasted lower section, a truss member separating the floating hull from the lower ballasted section; and an anchoring system connecting the hull to the ocean floor. The Examiner concedes that Horton '467 fails to disclose or suggest a vertically oriented fairing shape profile section formed by an outer wall of the hull. It is asserted that Moisdon '959 discloses a vertical watercraft utilizing buoyancy principle comprising of a hull having a vertically oriented fairing shaped profile being formed by an outer wall of the hull as depicted in Figs. 4-6. The Examiner states that it would have been obvious to one of

ordinary skill in the art at the time the invention was made to modify the outer wall for the hull portion to be fairing-shaped as taught by Moisdon '959 in order to provide less resistance to lateral forces resulting from water current drag and vortex-induced-vibration (VIV).

Attorney respectfully traverses the rejection as it applies to claims 1 and 2. Attorney is submitting the following articles as an indication of what was generally known in the industry; and while Attorney does not believe that they constitute material references, they are being submitted as part of a Supplemental Information Disclosure Statement: King, R. *Vortex Excited Structural Oscillations of a Circular Cylinder in Steady Currents*, OTC 1948, 6<sup>th</sup> Annual Offshore Technology Conference, Houston, Texas May 6-8, 1974; Griffin, O., *Some Recent Studies of Vortex Shedding with Application to Marine Tubulars and Risers*, Proceedings of the First Offshore Mechanics/Arctic Engineering/Deepsea Systems Symposium, American Society of Mechanical Engineers, New Orleans, Louisiana 1982; and Rogers, A.C., *An Assessment of Vortex Suppression Devices for Production Risers and Towed Deep Ocean Pipe Strings*, OTC 4594, Proceedings of the 15<sup>th</sup> Annual Offshore Technology Conference, Houston, Texas May 2-5, 1983.

When a fluid flows past a stationary body, i.e., restrained body, such as a cylinder, a periodic wake is formed by pairs of vortices shed from alternate sides of the body. The frequency with which the vortices occur is well known in the art and can be expressed as a function of the dimensionless Strouhal number  $S$ :

$$S = \frac{f_v D}{V}$$

where  $f_v$  is the frequency of the vortex shedding,  $D$  is the diameter of the cylinder, and  $V$  is the fluid velocity about the body.

However, where the body is flexibly mounted or free to oscillate, such as in Moisdon '959, vortex shedding does not create a major problem and occurs under only specific conditions. See, King, R., Sec. 2.2, Fig. 1 (a stationary body) and Fig. 2 (a flexibly mounted cylinder). Moisdon '959 is not a stationary structure, in contrast to a moored spar or riser. As a maritime vessel, it is by definition, a flexible body within the current stream, i.e., unrestrained at either end. As noted in the King article, Strouhal number and drag coefficient remain within a known defined range for a broad range of Reynolds numbers. More importantly, it generally does not suffer from VIV. Because Moisdon '959, like most maritime vessels does not suffer

from or address VIV suppression, it would not have been obvious to one of ordinary skill in the art to combine the teachings of the fixed SPAR of Horton '467 with Moisdon '959 to achieve the benefits of VIV suppression of the present invention.

Attorney further submits that, as a maritime vessel, Moisdon '959 is not analogous art. The present invention is directed to an anchored structure utilized for hydrocarbon recovery, i.e., exploration and production activities. By nature, exploration and production activities require that the structure maintain some relatively fixed position relative to the sea floor. In the present invention, it may be accomplished utilizing illustrative mooring line 24 lines (Fig. 3) to anchor the structure relative to the seabed. In contrast, Moisdon '959 does not teach, disclose or suggest a structure (a) intended for hydrocarbon recovery, (b) capable of supporting the attendant subsea equipment, such as risers 16, Fig. 3, or (c) maintaining a fixed position relative to the seabed. Moisdon '959 does not disclose a dynamic position capability or an anchoring system capable of maintaining position or station keeping. The fact that Moisdon '959 and the present invention both address structures that are placed in the sea does not make Moisdon '959 analogous art. See, *In re Clay*, 966 F.2d 656, 659 (Fed. Cir. 1992) (the Court holding that Board of Patent Appeals erred in finding that the cited art was within the same field of endeavor "merely because both relate to the petroleum industry"). Moisdon '959 is directed to a maritime vessel, whereas the present invention is directed to a relatively fixed offshore structure. It is clear that Moisdon '959 is not within the field of endeavor.

Moreover, Moisdon '959 is not reasonably pertinent to the particular problem addressed by the present invention – suppression of VIV stress in a restrained body subjected to fluid flow. As noted above, Moisdon '959 teaches a maritime vessel that is unconstrained at the surface or subsea. Because it is not constrained, it does not suffer from VIV as noted above. As such, Moisdon '959 is not even pertinent to the problem addressed by the present invention. Attorney respectfully submits that Moisdon '959 does not constitute analogous art under MPEP §2141.01(a) and cannot be considered as proper art in the rejection of claims 1 and 2 under §103(a). For the reasons stated above, Attorney respectfully submits that amended claim 1 and claim 2 are allowable over the cited art.

Paragraph 8 of the Office Action rejects claims 4 and 5 under 35 U.S.C. §103(a) as being unpatentable over Horton '467 as modified by Moisdon '959 as

applied to claims 2 and 6, respectively and in further view of Schuh '096. It is stated that the combination of Horton '467 and Moisdon '959 fail to disclose the chord to thickness ratio between about 1.10 and 1.5. It is asserted that Schuh '096 discloses a streamlined riser pipe comprising an ultra-short fairing assembly having the claimed chord to thickness ratio. The Examiner states that in view of Schuh '096, it would have been obvious to one of ordinary skill in the art to modify the combination of Horton '467 and modified by Moisdon '959, incorporating the fairing shape of Schuh '096 to arrive at the claimed invention. Attorney respectfully traverses the rejection.

As noted above, the combination of Horton '467 and Moisdon '959 does not teach a faired SPAR. At most it teaches a SPAR and a maritime vessel with a vertical hull having a wing-like cross section. Moreover, Schuh '096 teaches a faired riser. As noted previously, Reynolds numbers for production risers and drilling risers are in the range of 50,000 to 100,000 and 1 million to 2 million, respectively. SPAR type structures have Reynolds numbers on the order of 5 to 50 million. Specification p.4, lines 7-25. Schuh '096 discloses a riser fairing that would, given the size of conventional risers, fall within either the production or drilling riser range.

The disclosure of a short length to chord ratio as applied to risers in Schuh '096 does not lead to its application to structures having high Reynolds numbers such as the claimed SPAR. In Rogers, Table 1 sets forth various types of VIV suppression devices and their effectiveness over specific ranges. It discusses fairings having a length of 2.4 diameters and a width of 1.1 diameters. Further, it notes that fairings are effective in the Reynolds number range of  $1.7 \times 10^3$  to  $1.5 \times 10^6$ , far lower than the Reynolds numbers accompany SPARs. Moreover, it is noted that a fairing "must be allowed to rotate 360° about their cylinder mount". Rogers, OTC 4594 at 120-21. The present invention utilizes non-rotating fairings at very high Reynolds numbers – contrary to conventional thought. Attorney respectfully submits that one of ordinary skill in the art would not be motivated to combine Schuh '096 with the teachings of Horton '467 and Moisdon '959 (improper as it is). Moreover, since Moisdon '959 is non-analogous art, the Examiner's rejection of amended claim 1 and claim 2 should not stand. Attorney submits that claim 4 and 5 are allowable over the cited art as they depend from claim 2, which is itself allowable. Accordingly, claims 1, 2, 4 and 5 are allowable over the cited art.

Rejection of Claims 1, 2 and 4-8 under Obviousness-Type Double Patenting

Paragraphs 9 – 11 of the Office Action reject claims 1, 2 and 4-8 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-3 of U.S. Patent 6,196,768 in view of Horton '467. Attorney is concurrently filing (a) an assignment of the present application to Shell Oil Company, assignee of the '768 patent, and (b) a terminal disclaimer in compliance 37 C.F.R. §1.321(b) in order to overcome an actual or provisional rejection on this ground.

Miscellaneous

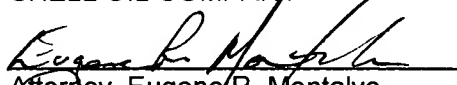
Attorney does not believe that a response is required to Paragraphs 12 and 13 of the Office Action, as claims 1, 2, 4 and 5 are allowable over the cited art. Accordingly, the objections and suggested amendments set forth in Paragraph 13 are moot. Attorney will respond to the statements made by the Examiner with respect to Allen US Patent 6,223,672 when the Allen '672 is cited as prior art against the claims.

Conclusion

Attorney has responded to each and every objection and ground for rejection set forth in the Office Action and believes that the claims are now in a state ready for allowance. In the event the Examiner has any questions or there exist issues with respect to this application, the Examiner is invited to call the undersigned at the telephone number set forth below to address such matters prior to the issuance of any formal action.

Respectfully submitted,

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